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D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA  
NATIONAL DAM INSPECTION PROGRAM. WAYNESBURG WATER COMPANY DAM (---ETC(U)  
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DACW31-79-C-0014

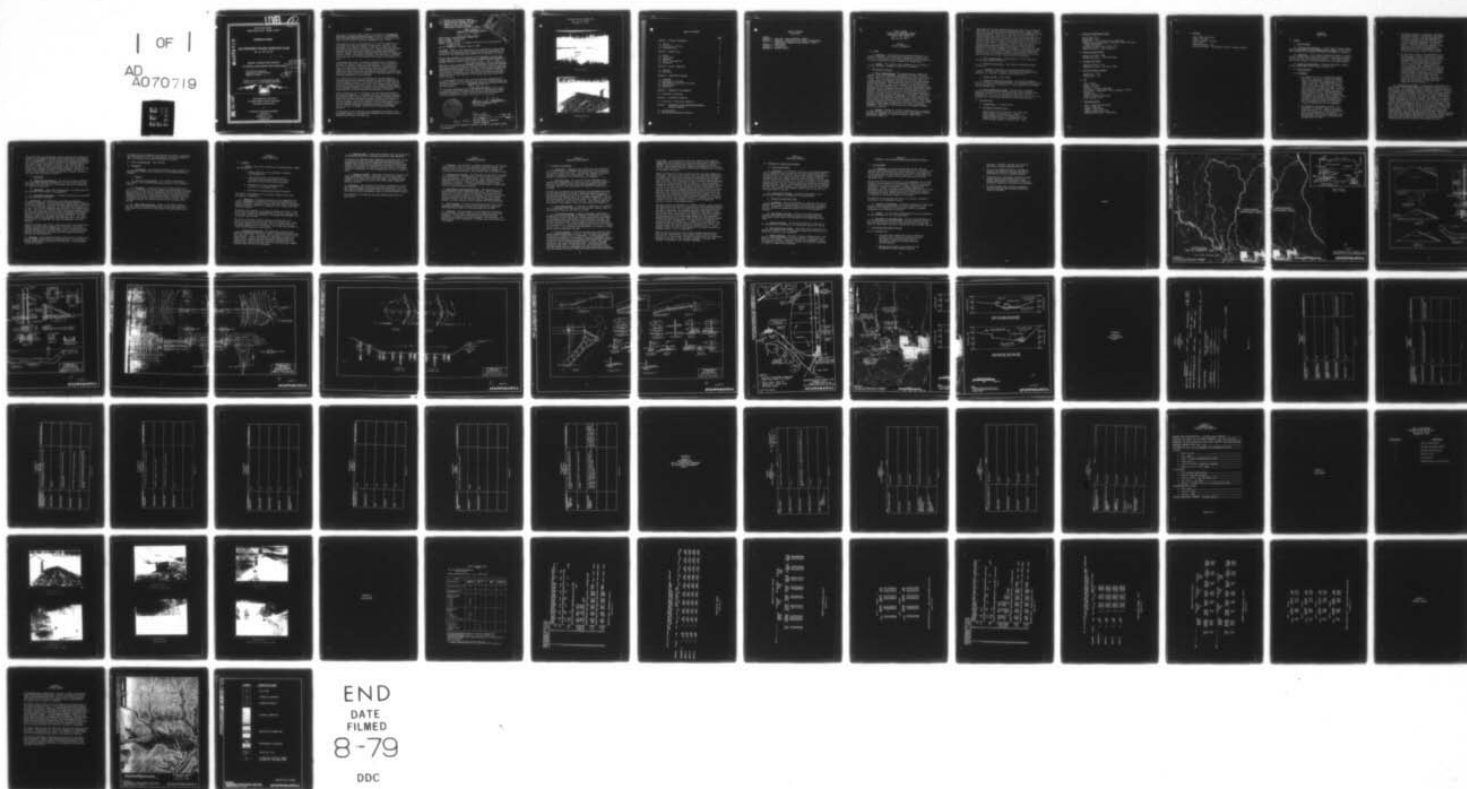
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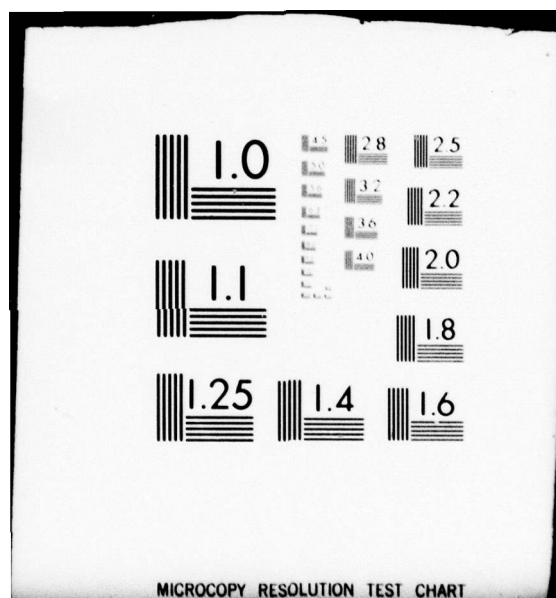
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No  
Box 1





LEVEL *B.S. 1*

OHIO RIVER BASIN  
WISECARVER RUN , GREEN COUNTY

PENNSYLVANIA

WAYNESBURG WATER COMPANY DAM

NDI I.D. NO: PA-195

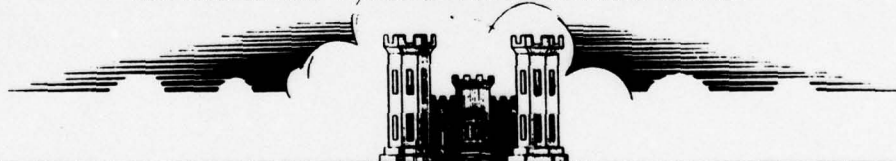
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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

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PREPARED FOR

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS  
BALTIMORE, MARYLAND 21203

BY

D'APPOLONIA CONSULTING ENGINEERS  
10 DUFF ROAD  
PITTSBURGH, PA. 15235  
JANUARY 1979

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## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

6 National Dam Inspection Program,  
Waynesburg Water Company Dam (NDI ID  
Number PA-195), Ohio River Basin,  
Wisecarver Run, Green County,  
Pennsylvania, Phase I Inspection Report.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

[CONT'D FROM  
P. 1]

11 Jan 79

NAME OF DAM: Waynesburg Water Company Dam

STATE LOCATED: Pennsylvania

COUNTY LOCATED: Greene

STREAM: Wisecarver Run, a secondary tributary of the South Fork of  
Ten Mile Creek

DATE OF INSPECTION: December 8 and 21, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed  
on the dates of inspection and as revealed by visual observations, the  
condition of the Waynesburg Water Company Dam is assessed to be good.

The wet area located at the junction of the embankment and the right  
abutment should be monitored and necessary remedial work performed if  
seepage conditions develop.

15 DAW 31-79-C-0014  
According to the recommended criteria, the spillway capacity (30 percent  
PMF) is classified as seriously inadequate because it will not pass the  
recommended spillway design flood of half to full probable maximum flood  
(PMF) without overtopping, and it was judged that failure of the dam  
resulting from overtopping would significantly increase the downstream  
hazard of loss of life compared to the hazard which would exist just  
before failure.

13 71 P.  
It is recommended that the owner initiate additional hydrologic and  
hydraulic studies to more accurately ascertain the spillway capacity and  
the nature and extent of the improvements required to provide sufficient  
spillway capacity.

It is further recommended that in the event of unusually high runoff,  
an around-the-clock surveillance plan should be implemented to detect  
possible problems and a formal warning system should be developed to  
alert the downstream residents in the event of an emergency.



*Lawrence D. Andersen*  
Lawrence D. Andersen, P.E.  
Vice President

*G. K. Withers*

G. K. WITHERS  
Colonel, Corps of Engineers  
District Engineer

1 Mar 79

DATE

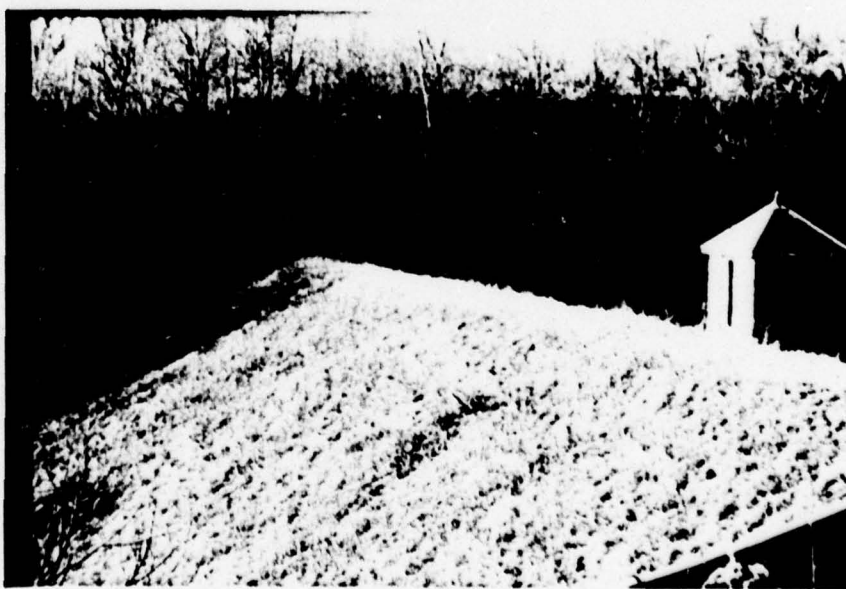
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Due to the seriously inadequate spillway, the Dam is considered "unsafe  
non-emergency."

WAYNESBURG WATER COMPANY DAM  
NDI I.D. NO. PA-195  
DECEMBER 18, 1978



Upstream Face



Downstream Face

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PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM  
WAYNESBURG WATER COMPANY DAM  
NDI I.D. NO. PA-195  
DER I.D. NO. 30-13

SECTION 1  
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The Waynesburg Water Company Dam consists of an earth embankment approximately 260 feet long with a maximum height of 33 feet from the downstream toe and a crest width of 17 feet. The flood discharge facilities for the dam consist of a combined primary and emergency spillway located on the left abutment (looking downstream). The overflow structure of the spillway is a 55-foot-long concrete ogee section located at an elevation approximately 6 feet below the dam crest. The flow from the overflow section discharges into a rectangular concrete discharge channel which terminates at a plunge pool at the toe level of the dam near the left abutment. The outlet works consist of a 16-inch cast-iron combined blow-off and supply pipe located near the left abutment. The pipe is encased in concrete through the embankment. The pipe receives flow from low-level and high-level intake structures, both equipped with trash screens, and discharges into the spillway channel. Flow through the pipe is controlled by a gate valve located in the concrete control structure situated near the midpoint of the conduit through the embankment. This outlet system constitutes the emergency drawdown facility for the dam.

b. Location. The dam is located on Wisecarver Run, a secondary tributary of the South Fork of Ten Mile Creek, approximately 1/2 mile northwest of Waynesburg in Franklin Township, Greene County, Pennsylvania (Plate 1).

[CONT'D  
ON P. 11]

Downstream from the dam, Wisecarver Run flows under Route 21, approximately 500 feet from the dam and joins Browns Creek. Browns Creek in turn flows into the South Fork of Ten Mile Creek approximately 1/2 mile further downstream. There are no structures on the flood plain of Wisecarver Run downstream from the dam. Five mobile homes and one gas station located near the confluence of Browns Run and South Fork of Ten Mile Creek would constitute the main impact area of a flood in the event of a dam failure. The water filtration plant is also located in the same area. It is estimated that a row of homes and several industrial and commercial warehouses located on Route 18 in West Waynesburg would also be damaged in the event of a flood due to a dam failure. It is further estimated that failure of the dam would cause large loss of life and property damage in the potential damage area described above and further downstream along the course of the South Fork of Ten Mile Creek where it flows south of Waynesburg.

c. Size Classification. Small (based on 33-foot height and 246 acre-feet storage capacity).

d. Hazard Classification. High (based on downstream damage potential).

e. Ownership. Southwestern Pennsylvania Water Authority (address: Mr. Ben Parker, Manager, Southwestern Pennsylvania Water Authority, P.O. Box 187, Jefferson, Pennsylvania 15344).

f. Purpose of Dam. Water supply.

g. Design and Construction History. The dam was designed by Mr. D. C. Morrow, a professional engineer from Washington, Pennsylvania. The dam was apparently constructed by a local contractor with completion in December 1931.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 966, the uncontrolled primary spillway crest elevation, leaving 6 feet of freeboard to the top of the dam at Elevation 972. Inflow occurring when the lake level is at or above the spillway level is discharged through the uncontrolled spillway.

### 1.3 Pertinent Data

a. Drainage Area - 3.9 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - 570 (June 1941)  
Outlet conduit at maximum pool - Unknown  
Gated spillway capacity at maximum pool - N/A  
Ungated spillway capacity at maximum pool - 2586  
Total spillway capacity at maximum pool - 2586

c. Elevation (USGS Datum) (feet)

Top of dam - 972  
Maximum pool - 972  
Normal pool - 966 (spillway crest elevation)  
Upstream invert outlet works - 935 lower intake; 953 upper intake (estimated)  
Streambed at center line of dam - 927  
Maximum tailwater - 939+ (June 1941)

d. Reservoir Length (feet)

Normal pool level - 3000  
Maximum pool level - 3500 (estimated)

e. Storage (acre-feet)

Normal pool level - 246  
Maximum pool level - 369 (top of dam)

f. Reservoir Surface (acres)

Normal pool - 17.5  
Maximum pool - 27.5

g. Dam

Type - Earth  
Length - 260 feet  
Height - 33 feet  
Top width - 17 feet (measured)  
Side slopes - Downstream: 2H:1V; Upstream: 2.5H:1V  
Zoning - No  
Impervious core - No  
Cutoff - Concrete cutoff wall  
Grout curtain - Yes

h. Regulating Outlet

Type - 16-inch cast-iron pipe  
Length - 200+ feet  
Closure - Gate valves  
Access - Control structure  
Regulating facilities - Gate valve

1. Spillway

Type - Ogee-crested weir

Length - 55 feet

Crest elevation - 966 feet

Gate - None

Upstream channel - Lake

Downstream channel - Rectangular concrete discharge channel

## SECTION 2 DESIGN DATA

### 2.1 Design

#### a. Data Available

(1) Hydrology and Hydraulics. A state report entitled, Report Upon the Application of the Waynesburg Water Company, dated June 11, 1931, summarizes the available hydrologic and hydraulic information.

(2) Embankment. The available information consists of various design drawings, construction specifications, construction progress reports, and past state inspection reports. A 1931 permit application report includes a detailed description of the design features.

(3) Appurtenant Structures. Available information includes design drawings and spillway design calculations.

#### b. Design Features

##### (1) Embankment

- a. As designed, the dam is a homogeneous embankment with a clay cutoff trench on the center line of the embankment, extending for the full length of the dam. The average depth of the cutoff trench was 17 feet with a top width of 12 feet and a bottom width of 6 feet. A concrete core wall 12 inches thick and 2 feet high was constructed along the center line of the trench (Plates 2 and 3). The specifications required that the cutoff trench be backfilled with puddle clay in layers not to exceed 4 inches in thickness and tamped by using mechanical equipment. The only internal drainage system for the embankment consists of a rock drain along the downstream toe of the embankment.
- b. The embankment was designed to have a 2 to 1 (horizontal to vertical) slope on the downstream face and 2.5 to 1 slope on the upstream face. The upstream face of the dam was protected with 12-inch-thick, hand-placed riprap extending from the crest elevation to the upstream toe of the dam.

- c. The boring locations for foundation exploration are shown in Plate 4. Boring logs, also shown in Plate 4, indicate that the subsurface profile along the axis of the dam consists of 2 to 5 feet of overburden underlain by alternating layers of shale and sandstone. The log of Boring 7, located on the right abutment, indicates that a coal seam was encountered at Elevation 970, which is approximately 4 feet above the normal pool level of the reservoir.
- d. As indicated in Plate 3, the foundation of the dam was grouted through a single line of grout holes extending from the right abutment through the embankment and through the crest of the spillway. The grouting pressures ranged from 30 to 50 psi with cement takes ranging from 6 to 175 bags per hole. Subsequent to the initial grouting, additional holes were drilled for pressure testing. The pressure testing was conducted under a pressure of 25 psi starting from the bottom of the puddle clay cutoff wall. The water takes per hole ranged from zero to 10 gallons per minute (gpm). The high water take rates in the pressure tests corresponded to the locations of high grout take during the initial grouting.

(2) Appurtenant Structures. The appurtenant structures of the dam consist of the combined emergency and primary spillway and the outlet works. The spillway structures consist of a concrete ogee overflow section and a rectangular concrete discharge channel. The spillway plan and profile are shown on Plate 5. The 55-foot ogee overflow section is located at Elevation 966, leaving 6 feet of freeboard as designed to the top of the dam. The approach channel is an unlined channel excavated into the left abutment. The bottom of the approach channel as designed is located at Elevation 964 providing a 2-foot approach depth at normal pool level. At the weir, short cutoff walls extend into the embankment on the right and into the abutment on the left. The concrete discharge channel is approximately 150 feet long and converges from a width of 55 feet at the ogee weir to 18 feet at the mid-length of the channel and then diverges to 28 feet at the downstream end. The concrete walls of the discharge channel are cantilever type and have a maximum height of 10 feet. The slab sections are 8 inches thick and are underlain by a french drain system. French drains are also located on the outside of the cantilever walls extending from the weir elevation to the plunge pool level.

The outlet works are located about 70 feet from the left abutment and consist of two submerged concrete intake structures at the upstream toe of the embankment, a 16-inch cast-iron pipe through the embankment, and a concrete control structure located at the upstream side of the dam crest at about mid-length of the pipe. The concrete control structure includes two gate valves which control flow through the outlet pipe. The gate valves are manually operated. The outlet pipe through the embankment is encased in concrete which includes two cutoff collars located near the upstream toe of the dam. Details of the outlet works are shown on Plate 2.

c. Design Data

(1) Hydrology and Hydraulics. The 1931 state report indicates that the primary spillway was designed for a flow of 638 cubic feet per second (cfs) per square mile of drainage area which corresponded to a capacity of 2500 cfs.

(2) Embankment. Other than design drawings, no engineering data are available on the design of the embankment.

(3) Appurtenant Structures. No design calculations are available for the appurtenant structures.

2.2 Construction. The construction of the dam was apparently conducted in accordance with the drawings and specifications prepared by the design engineer. Although the design drawings show a crest width of 12 feet, during this inspection the crest width was measured to be 17 feet. Very limited information was available on the construction of the dam. The state files include several construction progress reports. The available information indicates that the embankment was placed in layers not exceeding 6 inches in thickness and compacted by rollers exerting a pressure of 350 pounds per square inch (psi). The state inspection report dated September 1931 indicates that a test pit was excavated into the embankment and shows the embankment to be well compacted.

Although no reports were found to indicate any major post-construction change, field observations suggest that a portion of the spillway discharge channel slab was reconstructed. In the reconstructed slab, numerous drainpipes were installed which appear to extend through the concrete into the base of the slab, which are assumed to have been provided for uplift reduction.

2.3 Operation. Water company personnel reported that the reservoir is used as standby storage and only infrequently used. The reservoir is normally maintained at the spillway crest elevation by the discharge through the spillway.

No formal records of operation are available for review. Correspondence indicates that after the inspection of the dam by the state in 1961, the condition of the dam was assessed to be good.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. The available information was provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER).

b. Adequacy

(1) Hydrology and Hydraulics. The available information is very limited. Only the design discharge capacity of the spillway is reported.

(2) Embankment. In view of the age of the dam (completed in 1931), it is clear that the design approach and construction techniques are not likely to have been in conformance with the currently accepted engineering practices. Design documents lack such considerations as embankment slope stability and seepage analyses. However, the design incorporated such basic components as an impervious cutoff trench, foundation grouting, and riprap protection of the upstream slope of the dam.

(3) Appurtenant Structures. Review of the design drawings indicates that as designed no significant design deficiencies exist that should affect the overall performance of the appurtenant structures.

### SECTION 3 VISUAL INSPECTION

#### 3.1 Findings

a. General. The on-site inspection of Waynesburg Water Company Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.
2. Visual examination of the spillway and its components, the downstream end of the outlet pipe and the outlet works control structure.
3. Observation of factors affecting runoff potential of the drainage basin.
4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 6 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the dam is considered to be good. Only one wet area was observed about midheight of the dam at the junction of the right abutment and embankment. No seepage flow appeared to be associated with this area.

The top of the dam was surveyed relative to the spillway crest elevation and was found to have some vertical irregularities. While the design freeboard for the dam was 6 feet, the survey indicated freeboards ranging from 5.4 to 5.8 feet. The lowest area occurred in a short section adjacent to the spillway.

c. Appurtenant Structures. The appurtenant structures were examined for deterioration or other signs of distress and obstructions that would limit flow. In general, the structures were found to be in good condition. Cracks were observed in the masonry facing of the control tower. However, further observations indicated that the cracks did not extend through the reinforced concrete walls of the control tower. The blow-off pipe valve was operated by water company personnel and observed to be functional.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered with woodlands and has not been developed.

A review of the regional geology (Appendix E) indicates that the dam is situated on Lower Green and underlying Washington formations. Although these formations are considered to be susceptible to landslides in the vicinity of the dam and the reservoir, no significant evidence of landslides was observed which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. Downstream from the dam, Wisecarver Run flows approximately 500 feet south where it joins Browns Creek, a tributary of the South Fork of Ten Mile Creek. No conditions were observed in the downstream channel that might present significant hazard to the dam.

3.2 Evaluation. The condition of the dam is considered to be good. The vertical alignment of the dam crest was found to be 0.2 to 0.6 foot below the design elevation relative to the spillway crest level. This condition would consequently reduce the spillway design capacity.

The operation of the blow-off valve was observed and found to be satisfactory.

## SECTION 4 OPERATIONAL FEATURES

4.1 Procedure. The reservoir is normally maintained at the spillway crest level with excess inflow discharging over the spillway. The blow-off valve is used to draw down the reservoir or augment the downstream flow when required. The blow-off valve is normally closed.

4.2 Maintenance of the Dam. The maintenance of the dam is considered to be satisfactory. The downstream face of the dam is covered with grass and appears to be annually mowed. Water company personnel reported that there is no full-time dam tender responsible for the maintenance of the dam. The dam is maintained by water company personnel as required. It was further reported that no formal inspections of the dam are being conducted.

4.3 Maintenance of Operating Facilities. The maintenance of the operating facilities is considered to be fair. Due to inadequate access into the control tower, the blow-off valve located at the bottom of the control tower was not observed. However, the blow-off valve was operated and observed to be functional. Water company personnel reported that the blow-off valve is operated annually. However, no formal records of valve operation are being maintained.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via commercial establishments and homes 1/2 mile downstream from the dam.

4.5 Evaluation. The dam appears to be satisfactorily maintained. The dam is only informally inspected and no inspection reports are maintained. The dam and appurtenances should be periodically inspected with emphasis on the wet condition at the junction of the right abutment and the embankment to document that the conditions are not changing.

## SECTION 5 HYDRAULICS AND HYDROLOGY

### 5.1 Evaluation of Features

a. Design Data. Waynesburg Water Company Dam has a watershed of 3.9 square miles and impounds a reservoir with a surface area of 17.5 acres at normal pool level. The combined emergency and primary spillway is located on the left abutment. The capacity of the spillway is determined to be 2586 cfs with no freeboard.

b. Experience Data. As previously stated, Waynesburg Water Company Dam is classified as a small dam in the high hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass half to full PMF.

The PMF inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. Data used for the computer input are presented in Appendix D. The PMF inflow hydrograph was found to have a peak flow of 6897 cfs, while the half PMF inflow had a peak flow of 3449 cfs. The computer input and the summary of the computer output are also included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the spillway capacity would be significantly reduced in the event of a flood.

d. Overtopping Potential. Various percentages of PMF inflow hydrograph were routed through the reservoir to determine the percent of PMF inflow that the dam can pass without significantly overtopping the embankment, which could result in the breaching of the dam. The computer analyses indicate that the spillway can pass 30 percent PMF without overtopping. For 40 percent PMF, the dam would be overtopped for a duration of 3.3 hours with a maximum depth of 0.78 foot if failure did not occur. It is estimated that overtopping of the dam by 6 inches would initiate breaching of the dam.

e. Spillway Adequacy. Since the spillway cannot pass the recommended spillway design flood of half to full PMF without overtopping, the spillway is classified to be inadequate. A breach analysis was conducted to determine if the spillway is seriously inadequate, that is, if dam failure resulting from overtopping would significantly increase the loss of life or damage downstream from the dam over that which would exist just before overtopping failure. The breach analysis consisted of two steps. In the first step, the flood stage in the potential damage area was determined by routing through the reservoir and, downstream, the percent of PMF inflow that would initiate breaching

of the dam. In the second step, the flood stages in the potential damage area were determined by routing the same percent of PMF inflow combined with the discharge that would be contributed by the dam failure. Flood stages were then compared to determine if the loss of life or damage potential would be significantly increased due to failure of the dam by overtopping.

Plate 7 illustrates the cross sections at which the flood stages were determined. The first cross section, which is identified as Station 3, is located across Browns Creek immediately downstream from the mouth of Wisecarver Run. The second cross section was taken across the South Fork of Ten Mile Creek downstream from its confluence with Browns Creek. This cross section was identified as Station 4. Total flow passing through the spillway and over the dam was routed through these sections. In view of the uncertainties involved in the areal distribution of a storm that can cause overtopping failure and for the purpose of isolating and conservatively estimating downstream effects of flow from the dam site alone, discharge from Browns Creek and the South Fork of Ten Mile Creek were neglected in determining the flood stages. The flood stages that would exist just before overtopping failure of the dam are identified in the cross sections in Plate 7. Computer outputs labeled as Step 1 show the flood stages in the potential drainage area (Station 4) prior to overtopping failure.

The breach analysis incorporated in the HEC-1 computer program requires the estimation of the depth of overtopping that would initiate breaching, the time it would take for the breach to reach a specified depth after starting of the breach, and estimated geometry of the breach. Since the size and shape of a breach for an earth-fill dam cannot be readily determined, various breach sizes were assumed to observe the effect of varied assumptions on the flood stages downstream. Two trapezoidal breaches were assumed with base widths 100 feet and 200 feet and depths of 20 and 30 feet, respectively. For each breach, the duration to failure was taken as one-half hour. Further, it was assumed that the breaching would initiate when the dam is overtopped by 6 inches. The computer outputs for breach analysis are labeled as Step 2. In the computer outputs the results corresponding to each breach estimate are labeled as Plans 1 and 2, respectively.

Review of the flood stages in the potential damage area before and after failure indicates that flood stages would be raised by about five feet due to dam failure, and this is considered to be a significant increase in the loss of life or damage potential. Therefore, the spillway is classified to be seriously inadequate.

## SECTION 6 STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability

#### a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the performance of the structure, and no unsatisfactory conditions were reported in the past. Since the design lacks a positive internal drainage system, some concern exists as to the location of the phreatic surface through the embankment as it affects the stability of the embankment and the potential for internal erosion in the event a concentrated seepage develops. However, at the present time, other than an isolated wet area near the right abutment, the remaining portion of the toe area is firm, indicating that the phreatic surface does not intersect the downstream slope of the dam.

(2) Appurtenant Structures. Structural performance of the appurtenant structures is considered to be satisfactory.

#### b. Design and Construction Data

(1) Embankment. The dam was designed in 1931 when very limited understanding of geotechnical behavior of earth retention structures existed. Consequently, available design and construction information does not provide any quantitative data to aid in the assessment of stability.

(2) Appurtenant Structures. Review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of the appurtenant structures.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. There have been no reported post-construction modifications to the original design that would affect the structural stability of the embankment.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that the Waynesburg Water Company Dam is in good condition. No conditions were observed that would significantly affect the overall performance of the structure and none were reported in the past. To the extent that can be determined, it appears that the dam was constructed with reasonable care.

The wet area observed at the junction of the embankment and the right abutment is not considered to be significant relative to the overall performance of the dam at this time. However, this area should be periodically observed to determine if a seepage condition is developing. In view of the past problems encountered with the spillway discharge channel slab indicated by the post-construction repairs, the spillway discharge channel should also be periodically observed to determine if structural distress is developing.

The capacity of the spillway was found to be seriously inadequate according to the recommended criteria.

b. Adequacy of Information. Available information in conjunction with the visual observations and the previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the condition of the dam.

c. Urgency. The following recommendations should be implemented as soon as possible or on a continuing basis.

d. Necessity for Additional Data. In view of the inadequacy of the spillway capacity, the owner should initiate additional studies to more accurately ascertain the spillway capacity and the nature and extent of improvements required to provide sufficient spillway capacity.

7.2 Recommendations/Remedial Measures

It is recommended that:

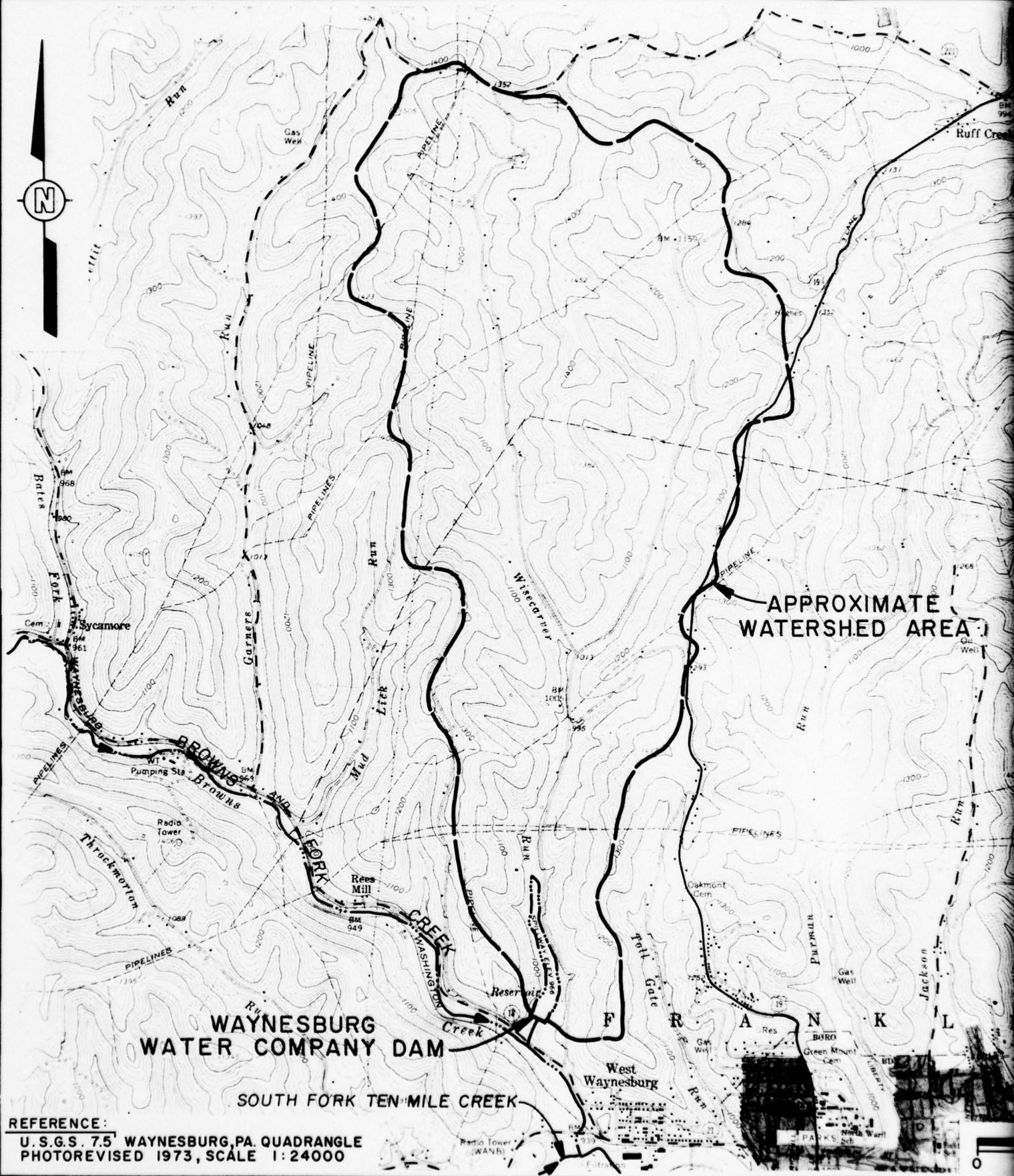
1. The owner should immediately initiate additional studies to more accurately ascertain the spillway capacity and the nature and extent of improvements required to provide sufficient spillway capacity.
2. The wet area located at the junction of the embankment and right abutment should be

monitored. Necessary remedial work should be performed if seepage conditions develop.

3. Crest of the embankment should be surveyed to establish the extent of low areas and the low areas should be filled to design elevation.
4. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of an emergency.
5. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

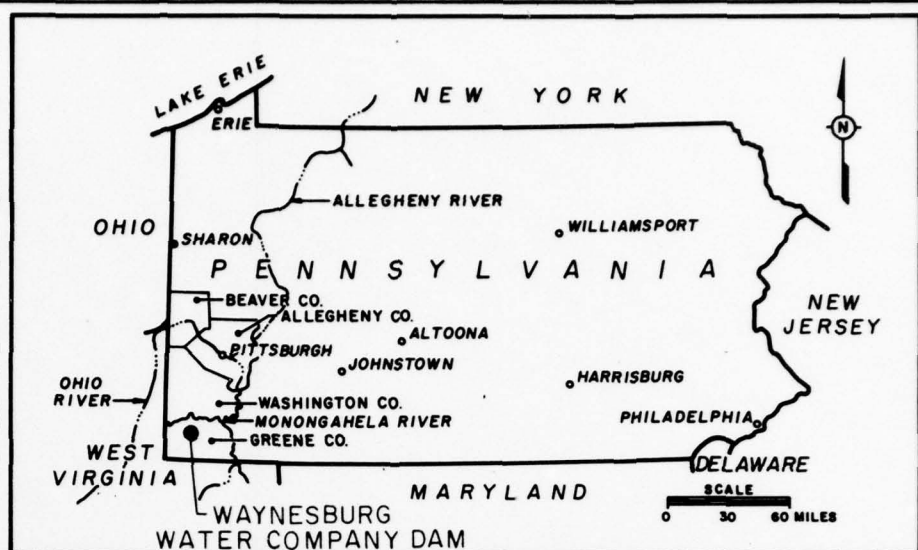
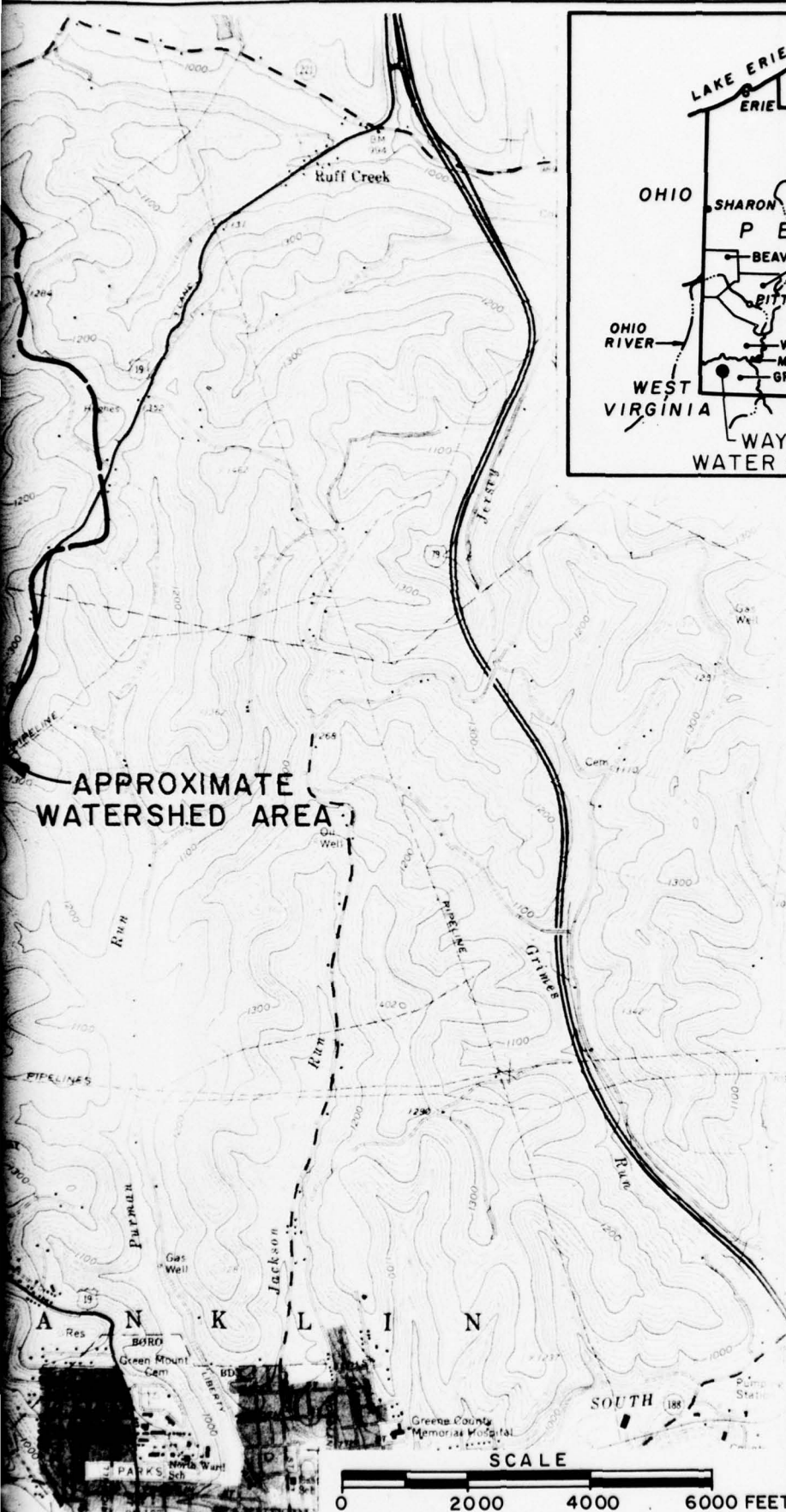
PLATES

DRAWN BY ACS CHECKED BY **BF** 1/16/77 DRAWING NUMBER 78-367-B1  
 12-28-78 APPROVED BY **JHP** 1/16/77



**REFERENCE:**

U.S.G.S. 7.5' WAYNESBURG, PA. QUADRANGLE  
 PHOTOREVISED 1973, SCALE 1:24000



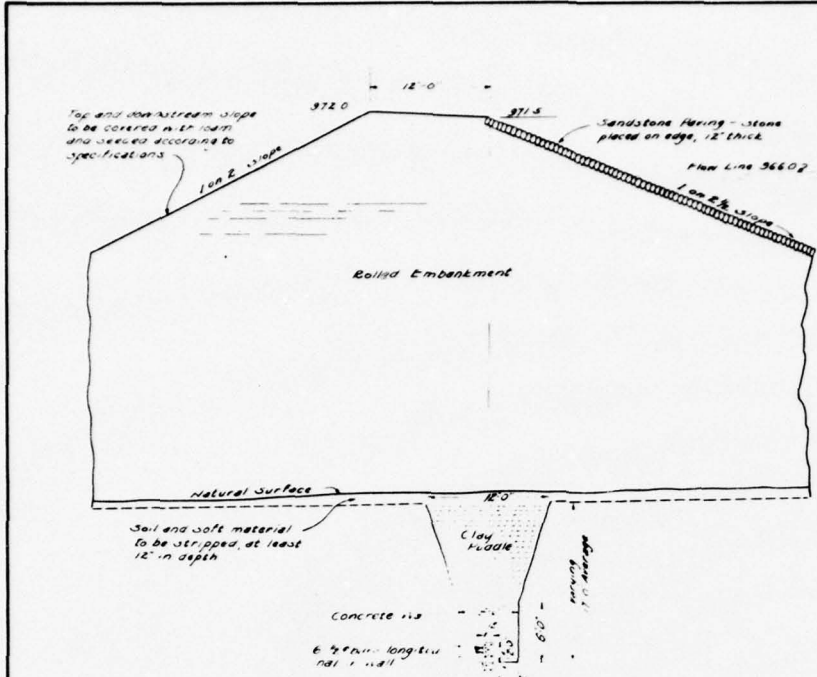
2

PLATE I

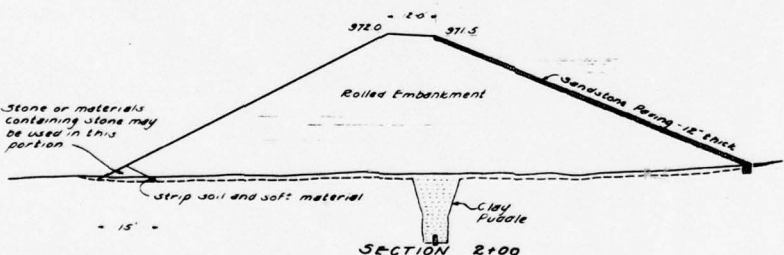
WAYNEBURG WATER COMPANY DAM  
VICINITY, FLOOD PLAIN & WATERSHED MAP

**D'APPOLONIA**

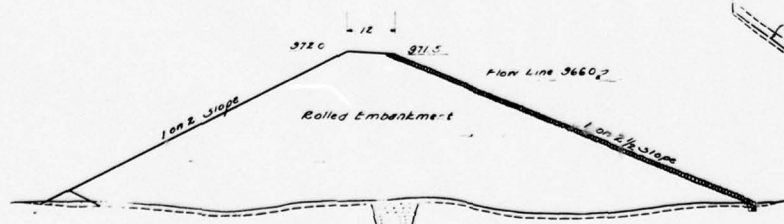
DRAWING 78-57-B2  
 1/16/77  
 CHECKED BY JEC  
 12-20-78  
 APPROVED BY JHP  
 DRAWN BY



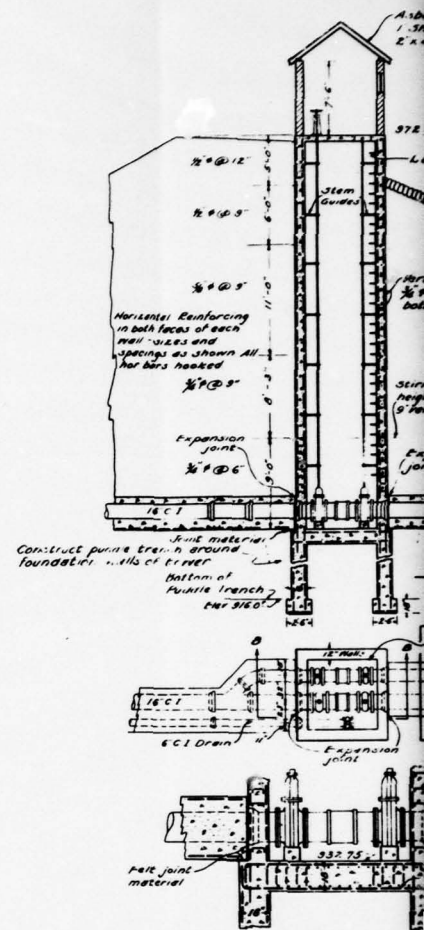
TYPICAL SECTION  
 Showing Cut-off Wall  
 Scale 1/8" = 1'-0"



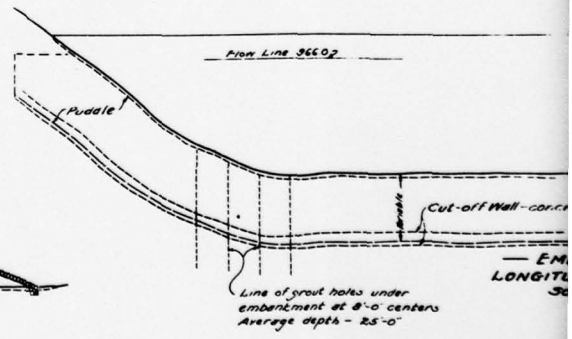
SECTION 2+00  
 Scale 1" = 20'



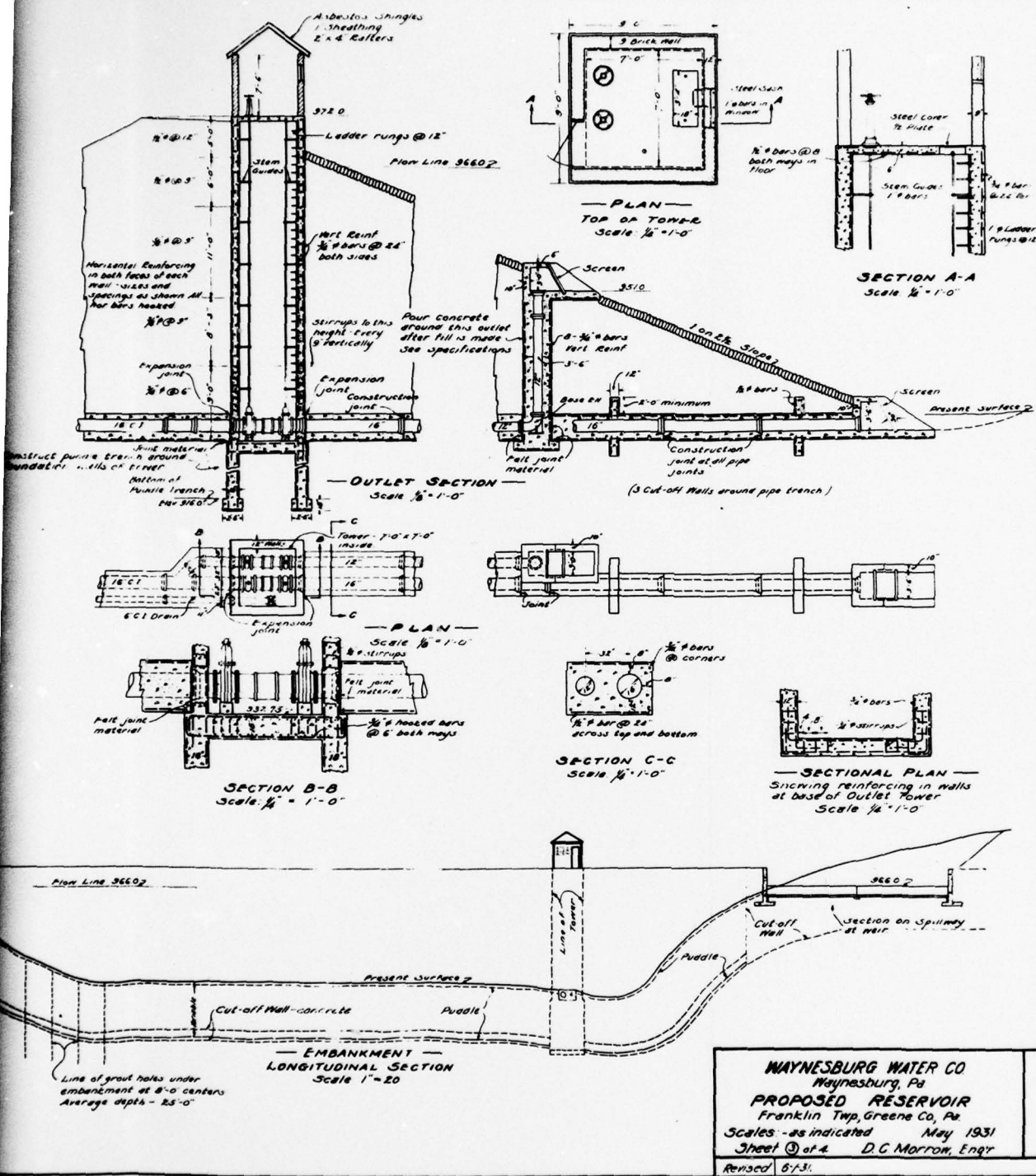
SECTION 1+30  
 Maximum Section  
 Scale 1" = 20'



SECTION B-B  
 Scale 1/4" = 1'-0"



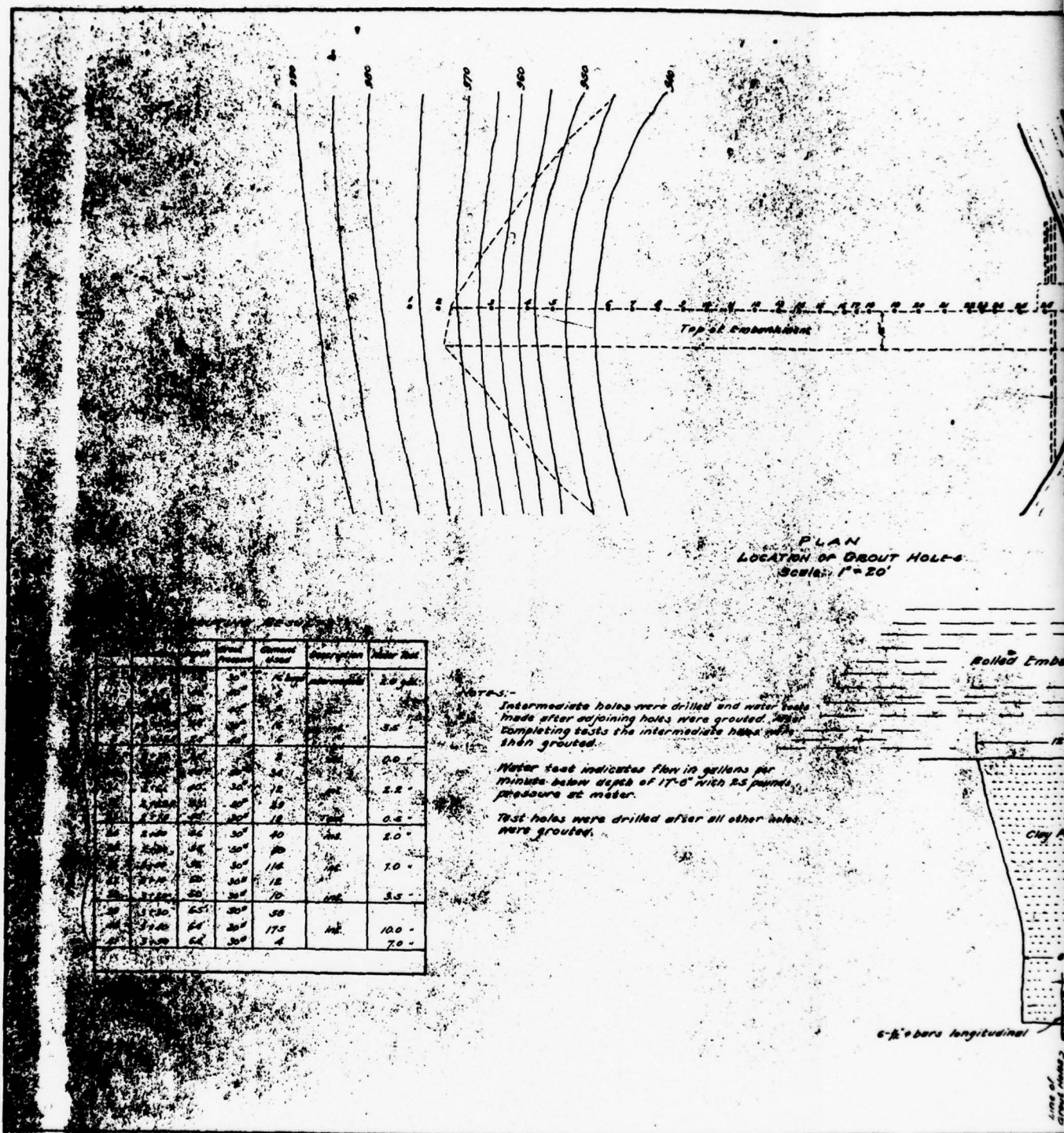
LONGITUDINAL SECTION  
 Scale 1" = 20'

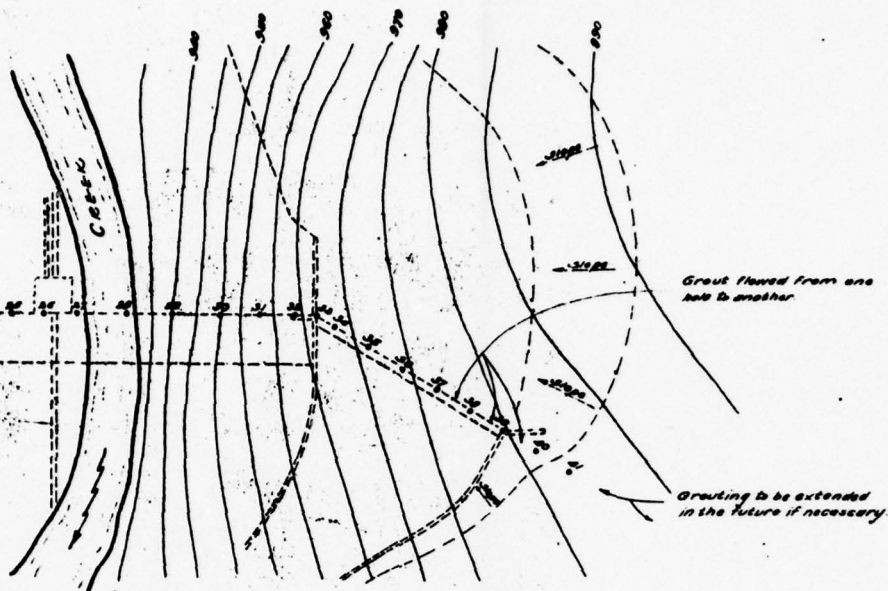


2

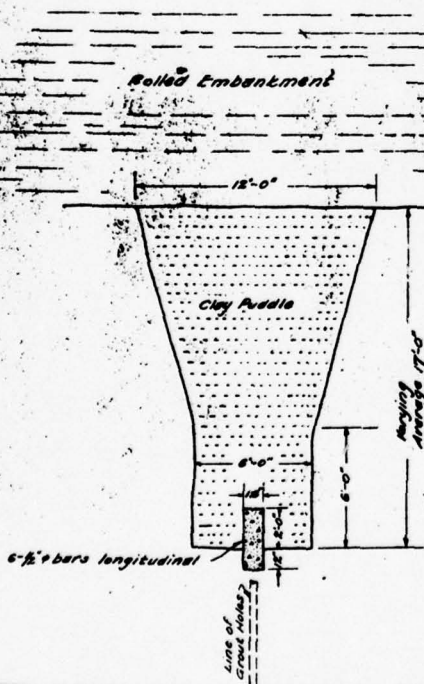
PLATE 2

D'APPOLONIA





PLAN  
LOCATION OF GROUT HOLES  
Scale: 1" = 20'



SECTION  
Showing Puddle Trench and Cut-off Wall  
Scale: 1/4" = 1'-0"

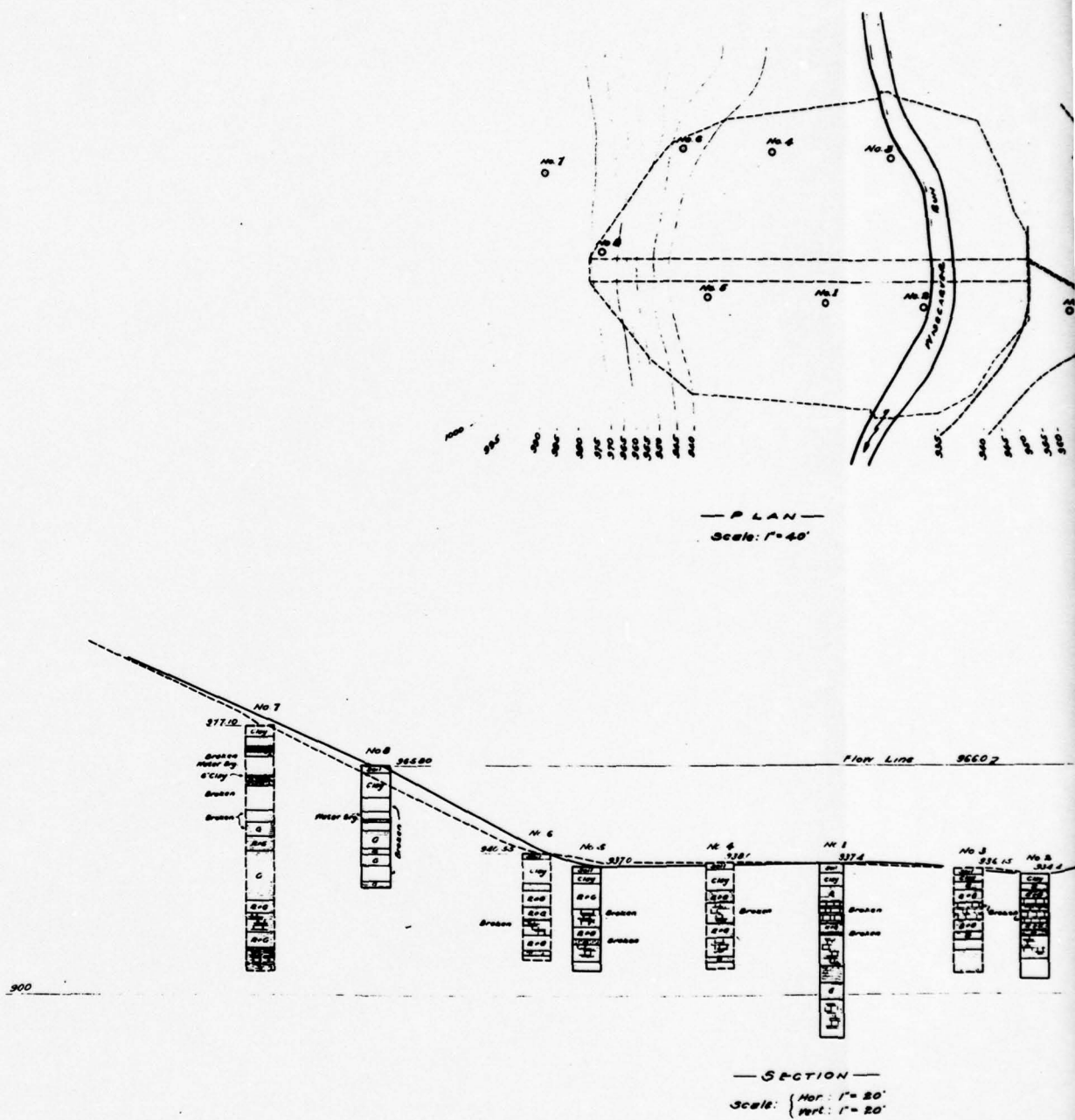
SUPPLEMENTARY SHEET

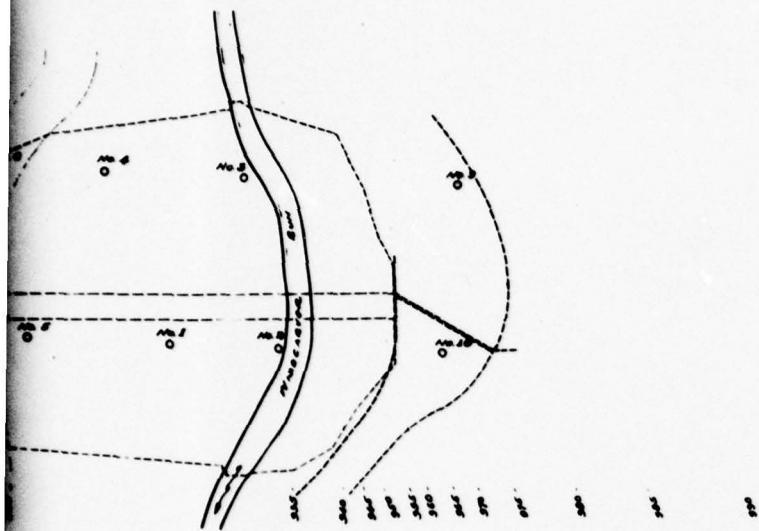
WAYNESBURG WATER CO.  
Waynesburg, Pa.  
STORAGE RESERVOIR  
Franklin Twp., Greene Co., Pa.  
Scale: - as indicated June 1931  
Sheet 5 D.C. MORROW, ENGR.

2

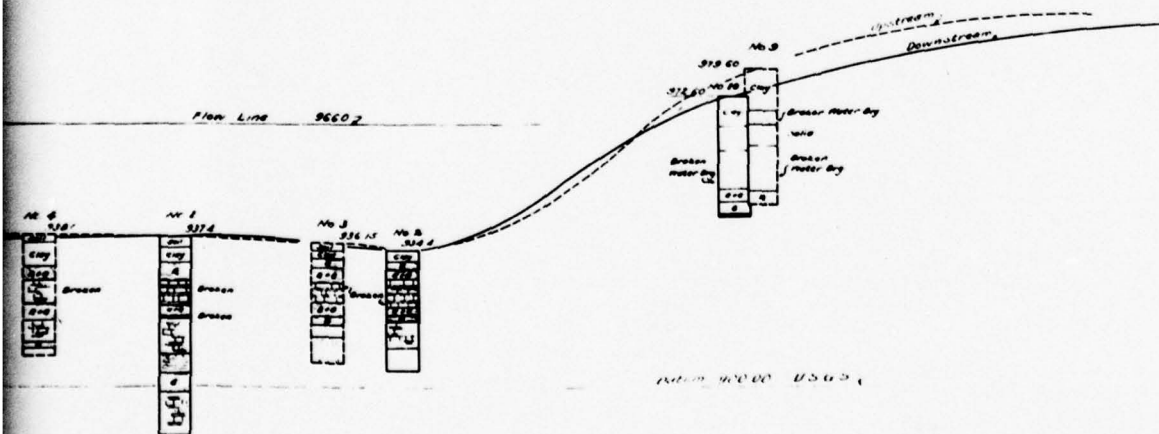
PLATE 3

D'APPOLONIA





PLAN  
Scale: 1" = 40'



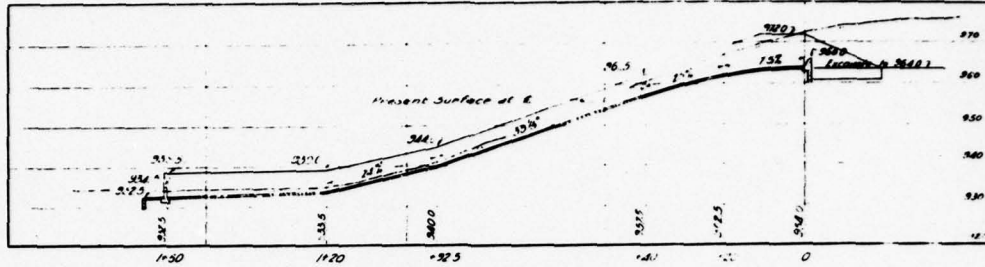
SECTION  
Scale: { Hor: 1" = 80'  
Vert: 1" = 20'

WAYNESBURG WATER CO.  
Waynesburg, Pa.  
STORAGE RESERVOIR  
Franklin Twp., Greene Co., Pa.  
Scale: as indicated May 1931  
Sheet 4 of 4 D.C. Morrow Engr.

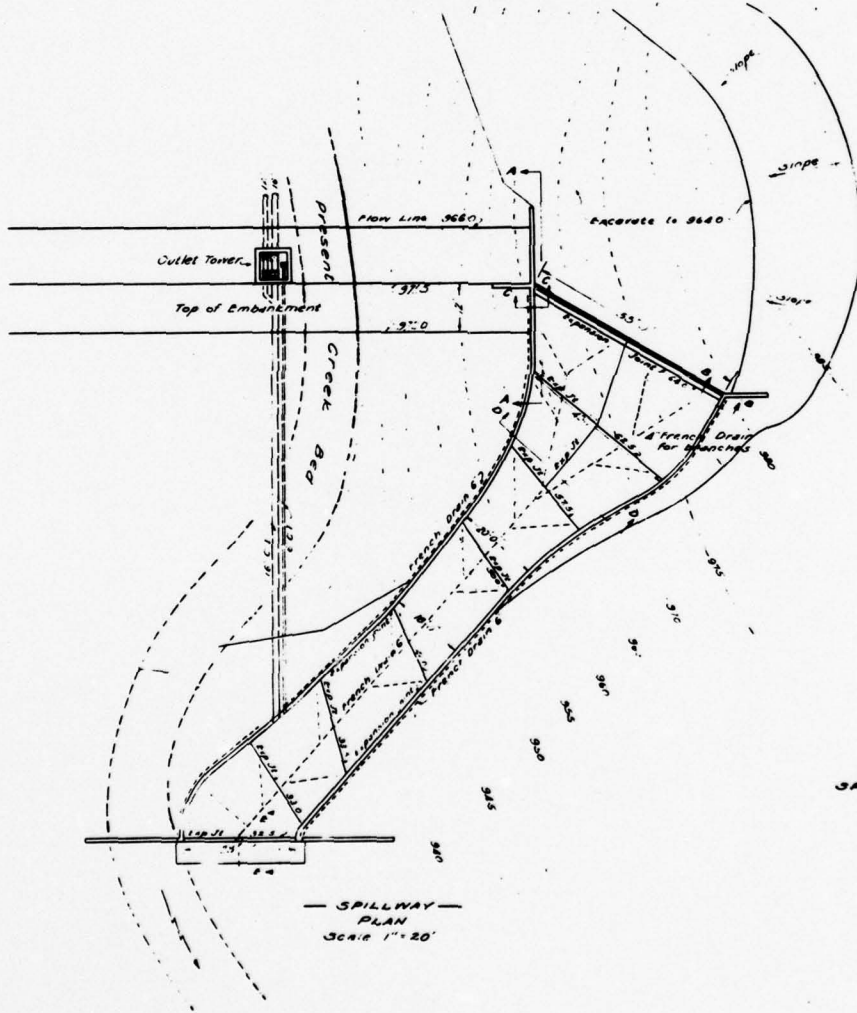
2

PLATE 4

D'APPOLONIA

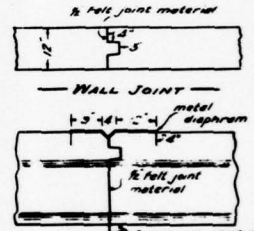


— PROFILE —  
Center Line of Spillway  
Scale: 1" = 20'

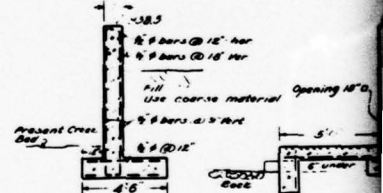


— SPILLWAY —  
PLAN  
Scale 1" = 20'

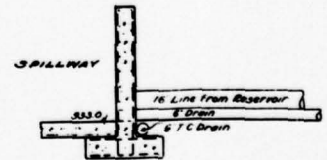
Construction joints to be made where necessary. All reinforcement be continuous at such joints.



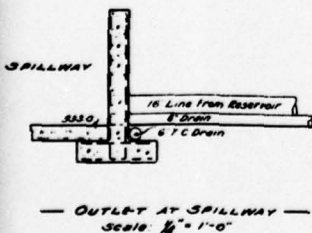
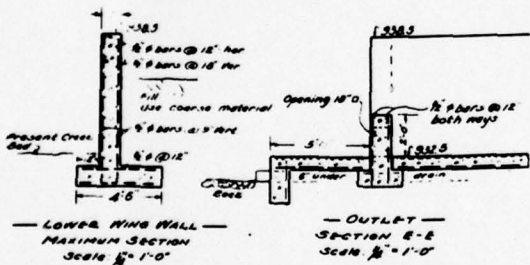
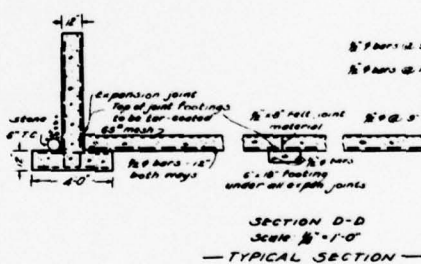
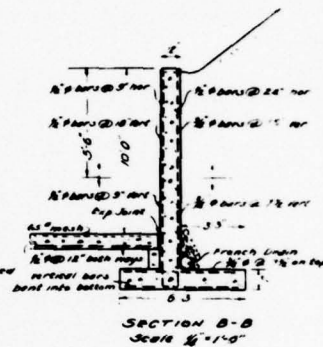
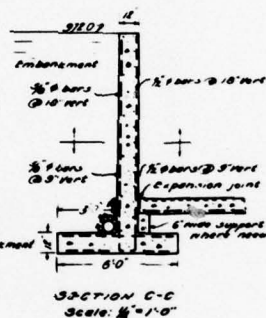
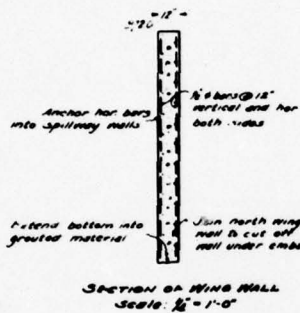
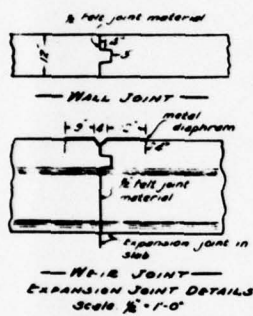
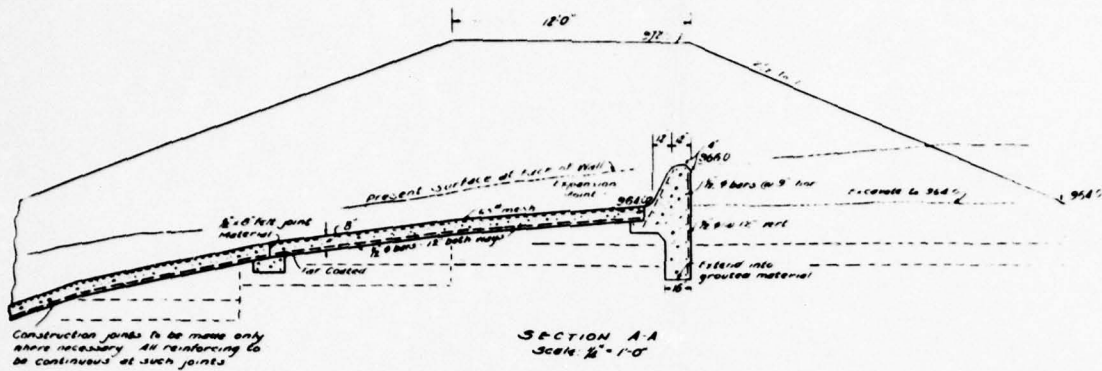
— WEIR JOINT —  
EXPANSION JOINT DETAILS  
Scale 1/2" = 1'-0"



— LOWER WING WALL —  
MAXIMUM SECTION  
Scale 1/2" = 1'-0"



— OUTLET AT SPILLWAY —  
Scale 1/2" = 1'-0"



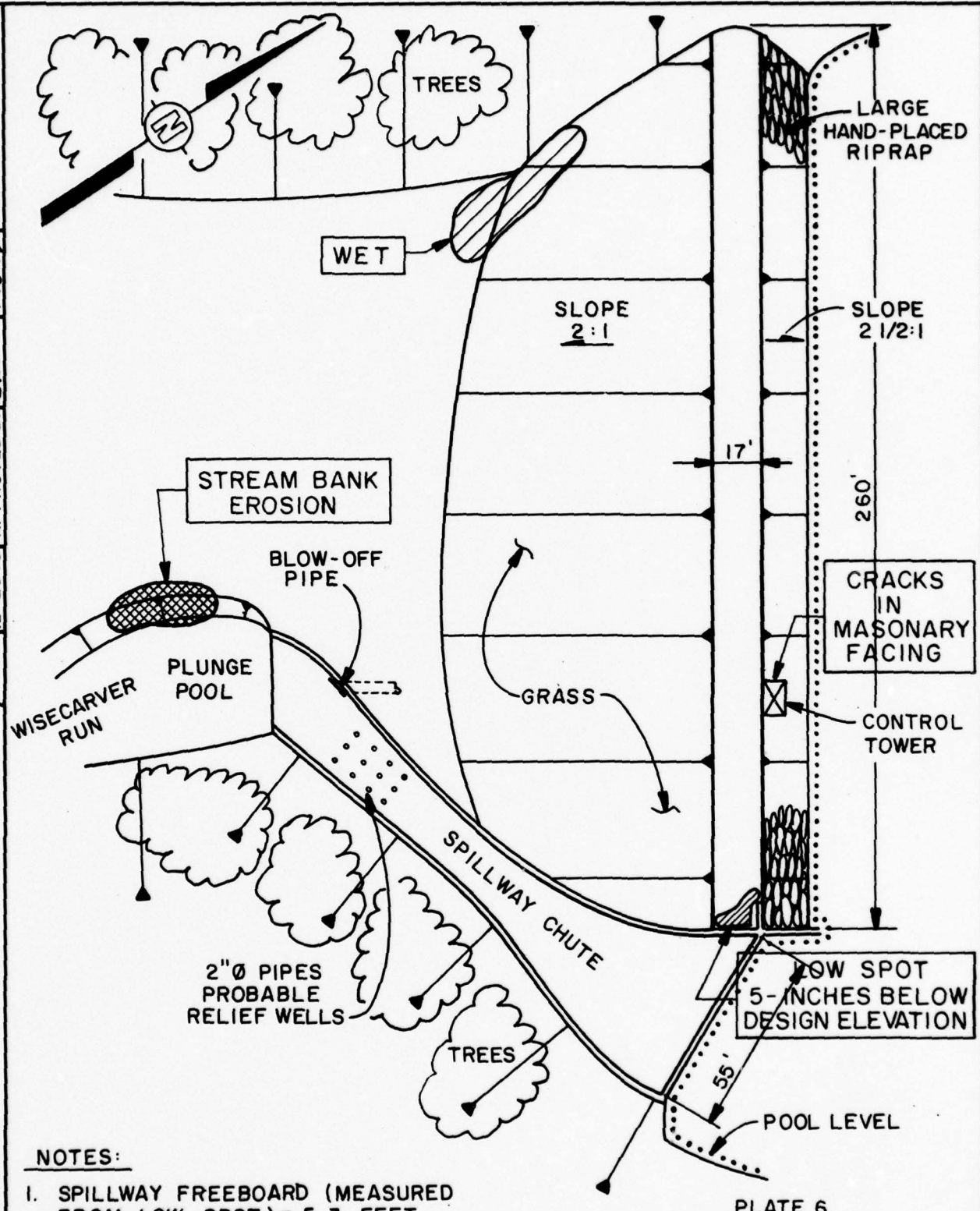
WAYNESBURG WATER CO.  
Waynesburg, Pa.  
STORAGE RESERVOIR  
Franklin Twp, Greene Co. Pa.  
Scales - as indicated May 1918  
Sheet 2 of 4 D.C. MORROW, E.C.

2

PLATE 5

D'APPOLONIA

DRAWN BY	RDB	CHECKED BY	BC	DATE	1/16/79	DRAWING NUMBER	78-367-A1
	12-28-78	APPROVED BY	JHP		1.16.79		



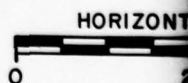
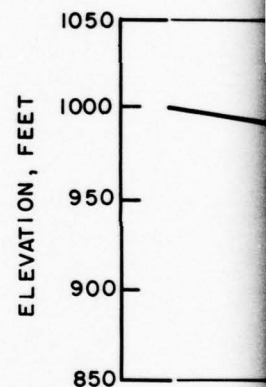
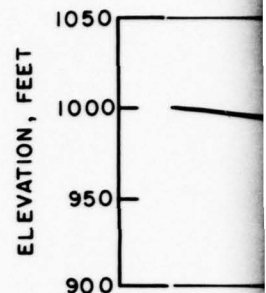
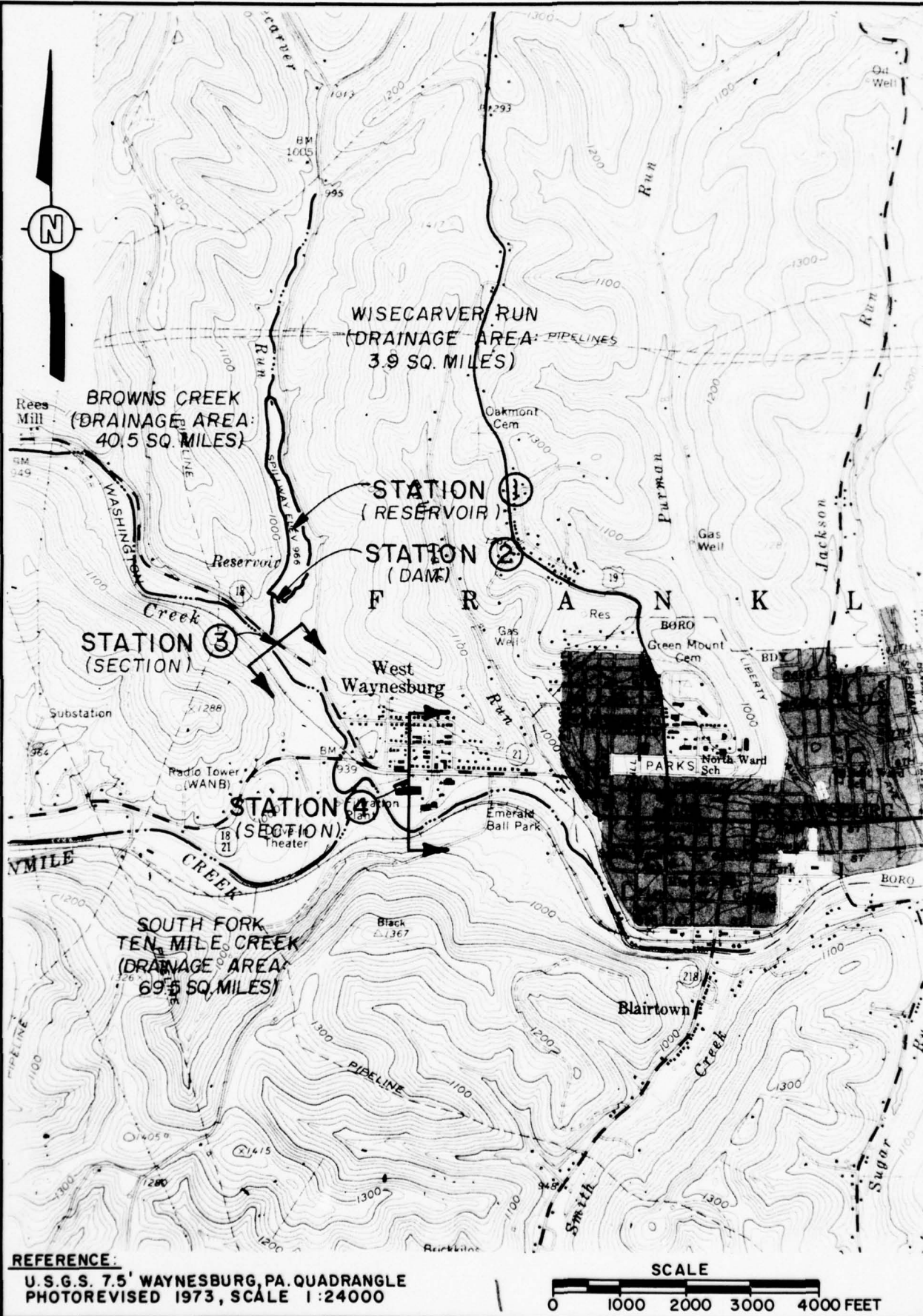
**NOTES:**

1. SPILLWAY FREEBOARD (MEASURED FROM LOW SPOT) = 5.3 FEET.
2. POOL LEVEL DATE OF INSPECTION: 1 INCH OVER SPILLWAY CREST.

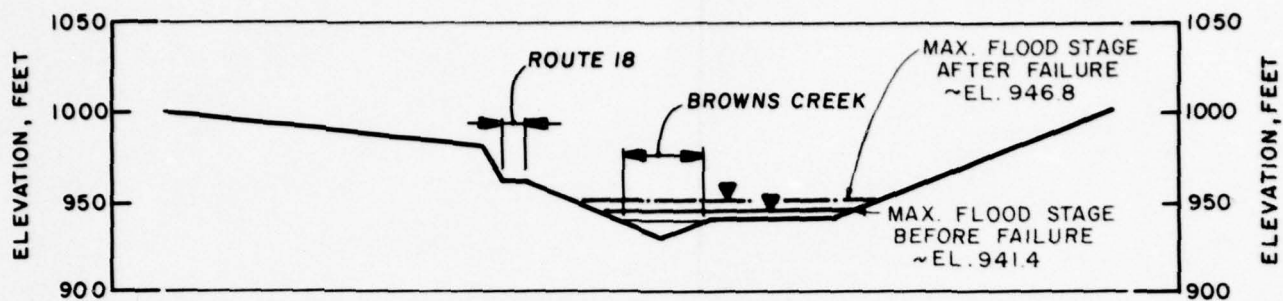
NOT TO SCALE

WAYNESBURG WATER COMPANY DAM  
GENERAL PLAN  
FIELD INSPECTION NOTES  
FIELD INSPECTION DATE: DEC. 8, 1978

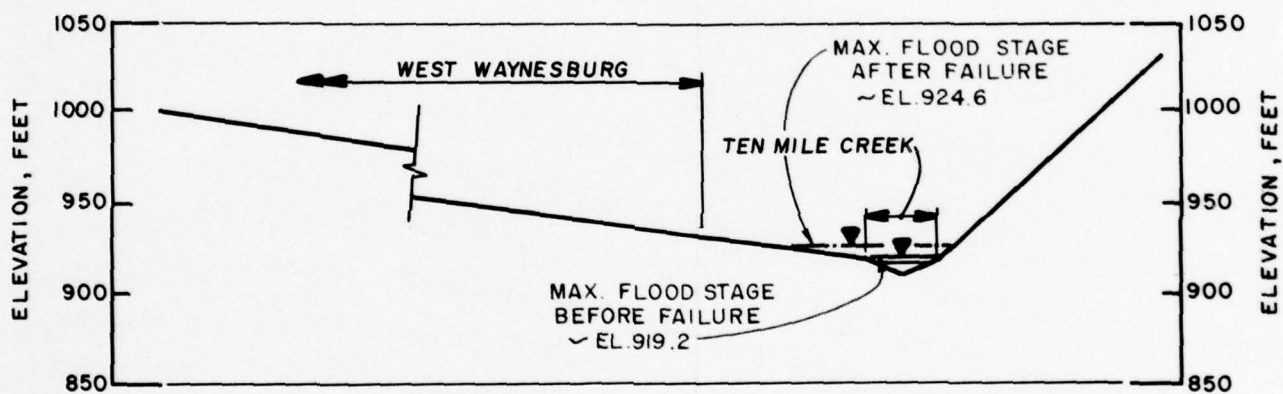
**D'APPOLONIA**



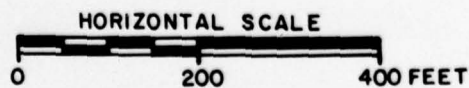
NOTE:  
 SECTIONS WERE  
 U.S.G.S. TOPOGR  
 APPROXIMATE.



SECTION @ STATION ③



SECTION @ STATION ④



**NOTE:**  
SECTIONS WERE DEVELOPED FROM  
U.S.G.S. TOPOGRAPHY AND ARE ONLY  
APPROXIMATE.

PLATE 7

**D'APPOLONIA**

APPENDIX A  
CHECKLIST  
VISUAL INSPECTION  
PHASE I

31

# APPENDIX A

## CHECKLIST VISUAL INSPECTION PHASE I

Waynesburg Water  
 NAME OF DAM Company Dam COUNTY Greene STATE Pennsylvania ID# PA-195  
 TYPE OF DAM Earth HAZARD CATEGORY High DER: 30-13  
 DATE(S) INSPECTION December 8, 1978 WEATHER Sunny TEMPERATURE 50s  
 POOL ELEVATION AT TIME OF INSPECTION 966.1 M.S.L. TAILWATER AT TIME OF INSPECTION 932 M.S.L.

### INSPECTION PERSONNEL:

Bilgin Erel

Wah Tak Chan

### REVIEW INSPECTION PERSONNEL:

(December 21, 1978)

L. D. Andersen

J. H. Poellot

B. Erel

Bilgin Erel RECORDER

VISUAL INSPECTION  
PHASE I  
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUCHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Crest elevation is 0.2 to 0.6 feet below design elevation relative to spillway crest level.	Crest should be surveyed and low spots should be filled.
RIPRAP FAILURES	None	

VISUAL INSPECTION  
PHASE I  
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	A wet area at the intersection of the embankment and the right abutment. No perceivable seepage.	Should be periodically observed to determine if a seepage condition is developing.
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION  
PHASE 1  
OUTLET WORKS

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	The blow-off pipe is a 16-inch-diameter cast-iron pipe. Only the downstream end is visible.	
INTAKE STRUCTURE	Submerged.	
OUTLET STRUCTURE	The blow-off pipe would discharge into the spillway discharge channel.	
OUTLET CHANNEL	Earth channel, no apparent significant obstructions.	
EMERGENCY GATE	A gate valve on 16-inch cast-iron pipe. The valve was operated by water company personnel and observed to be functional.	

VISUAL INSPECTION  
 PHASE I  
 UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	55-foot-wide concrete ogee weir. In good condition.	
APPROACH CHANNEL	Submerged. Appears to be free of debris.	
DISCHARGE CHANNEL	Rectangular concrete channel. In good condition.	
BRIDGE AND PIERS	None	

VISUAL INSPECTION  
PHASE 1  
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION  
PHASE I  
INSTRUMENTATION

VISUAL EXAMINATION OF MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

VISUAL INSPECTION  
PHASE I  
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle. No signs of landslides or shore erosion.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	None	

VISUAL INSPECTION  
PHASE I  
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No apparent obstructions immediately downstream from the dam that would affect the discharge capacity of the spillway.	
SLOPES	No apparent instability (immediately downstream from the dam).	
APPROXIMATE NUMBER OF HOMES AND POPULATION	The first impact area of a flood is located at the confluence of Browns Fork Creek and South Fork of Ten Mile Creek. There are five mobile homes, one gas station and a water filtration plant in this area. Population: approximately 25.	It is estimated that a significant portion of the community of West Waynesburg would also be affected in the event of a flood due to failure of the dam.

**APPENDIX B**  
**CHECKLIST**  
**ENGINEERING DATA**  
**DESIGN, CONSTRUCTION, OPERATION**  
**AND HYDROLOGIC AND HYDRAULIC**  
**PHASE I**

# APPENDIX B

## CHECKLIST

### ENGINEERING DATA

#### DESIGN, CONSTRUCTION, OPERATION

##### PHASE I

Waynesburg Water

NAME OF DAM Company Dam

ID# NDI: PA-195:

DER: 30-13

ITEM	REMARKS
AS-BUILT DRAWINGS	The design drawings are available in state files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by Mr. D. C. Morrow, a professional engineer from Washington, Pennsylvania. The construction of the dam was completed in December 1931.
TYPICAL SECTIONS OF DAM	See Plate 2.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plate 2.

**CHECKLIST**  
**ENGINEERING DATA**  
**DESIGN, CONSTRUCTION, OPERATION**  
**PHASE I**

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Spillway design capacity calculations are available in state files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Plate 4.

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	Not recorded.

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	Not available.
SPILLWAY PLAN SECTIONS DETAILS	See Plate 5.
OPERATING EQUIPMENT PLANS AND DETAILS	See Plate 2.

CHECKLIST  
ENGINEERING DATA  
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 3.9 square miles (wooded)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 966 (246 acre-feet)

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 972 (369 acre-feet)

ELEVATION; MAXIMUM DESIGN POOL: 972

ELEVATION; TOP DAM: 972 (as designed), 971.4 (measured low spot)

SPILLWAY:

- a. Elevation 966
- b. Type Ogee
- c. Width 55 feet (perpendicular to flow)
- d. Length N/A
- e. Location Spillover Adjacent to spillway
- f. Number and Type of Gates Ncne

OUTLET WORKS:

- a. Type 16-inch cast-iron pipe
- b. Location Near left abutment
- c. Entrance Inverts El. 935 and El. 953
- d. Exit Inverts El. 930<sup>±</sup>
- e. Emergency Draindown Facilities 16-inch blow-off pipe

HYDROMETEOROLOGICAL GAGES:

- a. Type None
- b. Location None
- c. Records None

MAXIMUM NONDAMAGING DISCHARGE: Spillway capacity

APPENDIX C  
PHOTOGRAPHS

LIST OF PHOTOGRAPHS  
WAYNESBURG WATER COMPANY DAM  
NDI I.D. NO. PA-195  
DECEMBER 18, 1978

<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Crest (looking east).
2	Spillway discharge channel.
3	Spillway stilling basin.
4	Spillway crest.
5	Control tower.
6	Downstream end of blow-off pipe.



Photograph No. 1  
Crest (Looking east).



Photograph No. 2  
Spillway discharge channel.



Photograph No. 3  
Spillway stilling basin.



Photograph No. 4  
Spillway crest.



Photograph No. 5  
Control tower.



Photograph No. 6  
Downstream end of blow-off pipe.

**APPENDIX D**  
**CALCULATIONS**

HYDROLOGY AND HYDRAULIC ANALYSIS  
DATA BASE

NAME OF DAM: Waynesburg Water Company Dam  
(NDI I.D. PA-195)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.3 INCHES/24 HOURS<sup>(1)</sup>

STATION	1	2	3	4
Station Description	Waynesburg Reservoir	Waynesburg Dam	Browns Creek	South Fork of Ten Mile Creek
Drainage Area (square miles)	3.9	-	-	-
Cumulative Drainage Area (square miles)	3.9	3.9	3.9	3.9
Adjustment of PMF for Drainage Area (2) <sup>(2)</sup>				
6 Hours	102	-	-	-
12 Hours	120	-	-	-
24 Hours	130	-	-	-
48 Hours	140	-	-	-
72 Hours	-	-	-	-
Snyder Hydrograph Parameters				
Zone <sup>(3)</sup>	29	-	-	-
$C_p/C_t$ <sup>(4)</sup>	0.5/1.6	-	-	-
L (miles) <sup>(5)</sup>	3.8	-	-	-
$L_{ca}$ (miles) <sup>(5)</sup>	2.1	-	-	-
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	2.973	-	-	-
Spillway Data				
Crest Length (ft)	-	55	-	-
Freeboard (ft)	-	6	-	-
Discharge Coefficient	-	3.2	-	-
Exponent	-	1.5	-	-

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients ( $C_p$  and  $C_t$ ).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.

$L_{ca}$  = Length of water course from outlet to point opposite the centroid of drainage area.

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 11 JAN 79  
 \*\*\*\*\*

1	A1	SNYDER UNIT HYDROGRAPH, FLOOD ROUTING, AND DAM OVERTOPPING ANALYSES
2	A2	WAYNESBURG WATER CO. DAM, GREENE COUNTY, MDI-10, PA195 PROJECT NO. 78-367-01
3	A3	FOR 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, AND 100% PPF
4	B	300 0 10 0 0 0 0 0 -4 0
5	B1	5
6	J	1
7	J1	0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 1.00
8	K	0
9	K1	CALCULATION OF INFLOW HYDROGRAPH TO WAYNESBURG WATER CO. DAM PA195
10	M	1 3.9 3.9
11	P	24.3 102 120 130 140
12	T	1.0 0.05 0.007
13	V	2.973 0.50
14	X	-1.0 -0.05 2.0
15	X	1
16	K1	ROUTING FLOW THROUGH WAYNESBURG WATER CO. DAM PA195
17	V	1 246.0
18	V1	1
19	SS	0.0 246.0 369.0 641.0
20	SE	933.5 966.0 971.5 980.0
21	SS	966.0 55.0 3.2 1.5
22	SD	971.35 3.08 1.5 260.0
23	SL	25.0 50.0 100.0 35.0
24	SV	972.05 971.35 971.65 971.75 971.63
25	K	1
26	K1	CHANNEL ROUTING USING MODIFIED PULS-REACH 2 TO 3 (BROWNS CREEK)
27	V	1
28	V1	1
29	V6	0.04 0.05 0.04 930.0 1000.0 1000.0 0.00125
30	V7	0.0 1000.0 350.0 980.0 370.0 960.0 400.0 960.0 550.0 930.0
31	V7	600.0 940.0 750.0 940.0 1000.0 1000.0
32	K	1
33	K1	CHANNEL ROUTING USING MODIFIED PULS-REACH 3 TO 4 (50. FORK TENMILE CREEK)
34	V	1
35	V1	1
36	V6	0.04 0.05 0.04 910.0 1000.0 4500.0 0.00445
37	V7	0.0 1000.0 150.0 980.0 450.0 960.0 1350.0 940.0 1700.0 920.0
38	V7	1750.0 910.0 1800.0 920.0 2100.0 1000.0
39	K	99

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .60	RATIO 7 .70	RATIO 8 .80	RATIO 9 1.00
HYDROGRAPH AT	1	3.90 ( 10.10)	1	690. ( 19.53)	1379. ( 39.06)	2069. ( 58.59)	2759. ( 78.13)	3449. ( 97.66)	4138. ( 117.19)	4828. ( 136.72)	5518. ( 156.25)	6897. ( 195.31)
	2	3.90 ( 10.10)	1	659. ( 18.65)	1338. ( 37.90)	2021. ( 57.22)	2672. ( 75.65)	3398. ( 96.21)	4092. ( 115.88)	4784. ( 135.48)	5475. ( 155.03)	6853. ( 194.07)
ROUTED TO	3	3.90 ( 10.10)	1	658. ( 18.64)	1337. ( 37.87)	2019. ( 57.18)	2671. ( 75.63)	3398. ( 96.22)	4090. ( 115.83)	4779. ( 135.32)	5470. ( 154.89)	6850. ( 193.97)
ROUTED TO	4	3.90 ( 10.10)	1	656. ( 18.59)	1333. ( 37.75)	2013. ( 57.01)	2663. ( 75.41)	3389. ( 95.97)	4079. ( 115.51)	4766. ( 134.96)	5455. ( 154.48)	6831. ( 193.44)

# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....									
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	ELEVATION		INITIAL VALUE	SPILLWAY CREST		TOP OF DAM		TIME OF FAILURE HOURS
		STORAGE	OUTFLOW		966.00	966.00	971.35	366.	
				246.	246.	246.	366.	2178.	
				0.	0.	0.			
	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF		TIME OF FAILURE HOURS		
					MAX	OUTFLOW			
					HOURS	HOURS			
.10	0.00	300.	659.	0.00	43.33	43.33	0.00		0.00
.20	0.00	332.	1338.	0.00	43.17	43.17	0.00		0.00
.30	0.00	360.	2021.	0.00	43.00	43.00	0.00		0.00
.40	.78	389.	2672.	3.33	43.17	43.17	0.00		0.00
.50	1.41	409.	3398.	5.17	43.00	43.00	0.00		0.00
.60	1.98	428.	4092.	6.33	42.83	42.83	0.00		0.00
.70	2.50	444.	4784.	7.33	42.83	42.83	0.00		0.00
.80	2.97	459.	5475.	8.17	42.83	42.83	0.00		0.00
1.00	3.85	487.	6853.	9.83	42.83	42.83	0.00		0.00

## SUMMARY OF OVERTOPPING ANALYSIS

PLAN 1 STATION 3			
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	658.	937.3	43.33
.20	1337.	938.9	43.17
.30	2019.	940.5	43.17
.40	2671.	941.4	43.17
.50	3398.	941.9	43.00
.60	4090.	942.5	43.00
.70	4779.	943.0	43.00
.80	5470.	943.5	42.83
1.00	6850.	944.5	42.83

PLAN 1 STATION 4			
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	656.	915.2	43.50
.20	1333.	916.5	43.33
.30	2013.	917.9	43.33
.40	2663.	919.2	43.33
.50	3389.	920.0	43.17
.60	4079.	920.6	43.17
.70	4766.	921.2	43.00
.80	5455.	921.8	43.00
1.00	6831.	923.0	43.00

BREACH ANALYSIS STEP 1: FLOOD STAGES BEFORE DAM FAILURE

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*****
FLOOD HYDROGRAPH PACKAGE (MEC-1)
DAM SAFETY VERSION      JULY 1978
LAST MODIFICATION      11 JAN 79
*****

1  A1 SNYDER UNIT HYDROGRAPH, FLOOD ROUTING, DAM OVERTOPPING BREACHES ANALYSES
2  A2 WAYNESBURG WATER CO. DAM, GREENE COUNTY, MDI-ID. PA195 PROJECT NO. 78-367-01
3  A3 FOR 352,402, AND 452PHF
4  B 300 0 10 0 0 0 0 0 -4 0
5  B1 5
6  J 2 3 1
7  J1 0.35 0.40 0.45
8  K 0 1
9  K1 CALCULATION OF INFLOW HYDROGRAPH TO WAYNESBURG WATER CO. DAM PA195
10  M 1 3.9
11  P 1 24.3 102 120 130 140
12  T 2.973 0.50
13  W -1.0 -0.05 2.0
14  X 1 2
15  K1 ROUTING FLOW THROUGH WAYNESBURG WATER CO. DAM PA195, DAM BREACHES
16  Y 1 246.0
17  Y1 1
18  SS 0.0 246.0 369.0 641.0
19  SE 933.5 966.0 971.5 980.0
20  SS 966.0 55.0 3.2 1.5
21  S0971.35 3.08 1.5 260.0
22  SL 25.0 50.0 50.0 100.0 35.0
23  S0972.05 971.35 971.65 971.75 971.63
24  SB 100.0 1 952.0 0.5 966.0 971.85
25  SB 200.0 1 942.0 0.5 966.0 971.85
26  K 1 3
27  K1 CHANNEL ROUTING USING MODIFIED PULS-REACH 2 TO 3 (BROWNS CREEK)
28  Y 1 1
29  Y1 1
30  Y6 0.04 0.05 0.04 930.0 1000.0 1000.0 0.00125
31  Y7 0.0 1000.0 350.0 980.0 370.0 960.0 400.0 960.0 550.0 930.0
32  Y7 600.0 940.0 750.0 940.0 1000.0 1000.0
33  K 1 4
34  K1 CHANNEL ROUTING USING MODIFIED PULS-REACH 3 TO 4 (SO. FORK TENNILE CREEK)
35  Y 1 1
36  Y1 1
37  Y6 0.04 0.05 0.04 910.0 1000.0 4500.0 0.00445
38  Y7 0.0 1000.0 150.0 980.0 450.0 960.0 1350.0
39  Y71750.0 910.0 1800.0 920.0 2100.0 1000.0
40  K 99
41

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COMPUTER INPUT: BREACH ANALYSIS STEP 2

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS		
				RATIO 1	RATIO 2	RATIO 3
				.35	.40	.45
HYDROGRAPH AT	1	3.90	1	2414.	2759.	3104.
	( 10.10)		( 68.36)(	78.13)(	87.89)(	
ROUTED TO	2	3.90	2	2414.	2759.	3104.
	( 10.10)		( 68.36)(	78.13)(	87.89)(	
ROUTED TO	3	3.90	1	2348.	9457.	9699.
	( 10.10)		( 66.48)(	267.78)(	274.65)(	
ROUTED TO	4	3.90	2	2347.	12843.	13071.
	( 10.10)		( 66.47)(	363.67)(	370.14)(	
ROUTED TO	5	3.90	1	2348.	8823.	9096.
	( 10.10)		( 66.49)(	249.84)(	257.56)(	
ROUTED TO	6	3.90	2	2348.	11369.	11647.
	( 10.10)		( 66.48)(	321.94)(	329.81)(	
ROUTED TO	7	3.90	1	2342.	7654.	7908.
	( 10.10)		( 66.33)(	216.73)(	223.93)(	
ROUTED TO	8	3.90	2	2342.	9187.	9463.
	( 10.10)		( 66.32)(	260.15)(	267.97)(	

**PLAN 1 .....**

RATIO OF PHF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY GUEST	TOP OF DAM	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.35	971.62	966.00	966.00	971.35	1.83	2368.	43.17	0.00
.40	971.99	246.	246.	966.	.96	10281.	42.73	42.33
.45	971.94	0.	0.	2178.	.80	10519.	42.23	41.83

**PLAN 2 .....**

RATIO OF PMF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CHEST	TOP OF DAM	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.35	971.62	966.00	956.00	971.35	1.83	2347.	43.17	0.00
.40	971.89	246.	246.	366.	.90	14853.	42.56	42.33
.45	971.93	0.	U.	2178.	.75	15086.	42.06	41.83

PLAN 1		STATION 3	
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.35	2348.	941.1	43.17
.40	8823.	945.6	42.67
.45	9096.	945.7	42.17

PLAN 2		STATION 3	
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.35	2348.	941.1	43.17
.40	11369.	946.8	42.67
.45	11647.	946.9	42.17

PLAN 1		STATION 4	
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.35	2342.	918.6	43.33
.40	7654.	923.7	42.83
.45	7908.	924.0	42.33

PLAN 2		STATION 4	
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.35	2342.	918.6	43.33
.40	9187.	924.6	42.83
.45	9463.	924.7	42.33

APPENDIX E  
REGIONAL GEOLOGY

## APPENDIX E REGIONAL GEOLOGY

The Waynesburg Water Company Dam is located on strata of the Dunkard Group (Pennsylvanian-Permian Age). The dam is located on the east flank of the Waynesburg Syncline, a small, gently folded structure. The bedding in the vicinity of the dam has a dip of approximately 50 feet per mile in a westerly direction.

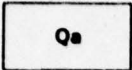
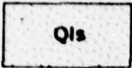
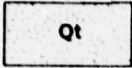
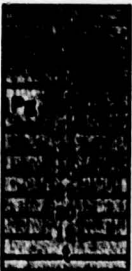



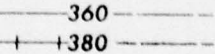
The strata in the vicinity of the dam consist of the lower portion of the Greene Formation and most of the underlying Washington Formation. The strata, in general, consist of fine-grained rock, such as shales, siltstone, and claystone interbedded with sandstone and limestone beds. The Greene Formation is predominantly gray shale with some thick gray to brown sandstone seams. The Washington Formation consists of the upper limestone, middle, and lower limestone members. The upper and lower limestone members are predominantly thin beds of limestone interbedded with fine-grained rock strata. The middle member is gray to black shale with some interbedded sandstone. The Jollytown coal seam, which is locally minable, crops into the left abutment of the dam. The rock is fractured and only moderately resistant to weathering.

The strata above and below the dam contain several coal seams which may be minable. These include the Jollytown, Waynesburg "A," Waynesburg, Sewickley, and Pittsburgh coal seams. No evidence was found to indicate that any mining has taken place in the vicinity of the dam.

The Greene and Washington formations are susceptible to landslides after weathering. Several large landslides have occurred in these strata within a few miles upstream of the dam, as indicated on the U.S. Geological Survey geologic map of the Waynesburg, Pennsylvania quadrangle, dated 1970.



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 2-5-79 2-6-79 2-8-79  
 APPROVED BY **CS**

<u>SYMBOL</u>	<u>FORMATION NAME</u>
	ALLUVIUM
	LANDSLIDE DEPOSITS
	TERRACE DEPOSITS
	GREENE FORMATION
	WASHINGTON FORMATION
	WAYNESBURG FORMATION
	ARTIFICAL FILL
	STRUCTURE CONTOUR - DRAWN ON BASE OF PGH. COAL BED

GEOLOGY MAP LEGEND

**REFERENCE:**  
 GEOLOGIC MAP OF THE WAYNESBURG QUADRANGLE  
 SOUTHWESTERN PENNSYLVANIA BY JOHN B. ROEN  
 DATED 1970, SCALE 1:24000

**D'AIPOLONIA**